BLS to ADF transition system

Signal Test Report

The transition system is basically a patch panel composes by three parts:

1. Patch panel cards
2. ~10 feet Pleated Foil cable (9 ft and 2 in for this test)
3. Paddle card.

1. Patch panel cards:
   Input: BLS cables (16 per card)
   Output: Pleated foil cables (2 per card)

2. Pleated foil cable:
   3M Pleated Foil Shielded Cable 90211 Series data sheet at Appendix
   Frank J. Cuzze made a measurement of the characteristic impedance of this cable in two ways, with an LCR meter, and with a TDR.
   a. LCR meter:
      Average Zo = 73.1 Ohms.
   b. TDR:
      Average Zo = 73.3 Ohms (shield grounded)
      Average Zo = 74.2 Ohms (shield floating)

3. Paddle Cards:
   Input: Pleated Foil Cable (2 per paddle card)
   Output to the ADF back plane.

The purpose of the test is to adjust the impedance matching between the BLS cables and the Pleated Foil cables and to see what is the frequency response of the system. The frequency response analysis also include the measurement of the fraction of the signal amplitude going out of the BLS cable transition system respect to the signal going out of the end of the BLS cables.

1. Impedance matching

   The patch panel cards have a place to add a serie resistance for each BLS cable to match their impedance with the impedance of the Pleated Foil cables.
   To run this test we used a spare BLS cable (Average Zo = 80 Ohms) connected as it is shown in the figure 1. It was sent a single signal in one channel with the shield of the Pleated Foil cable grounded.

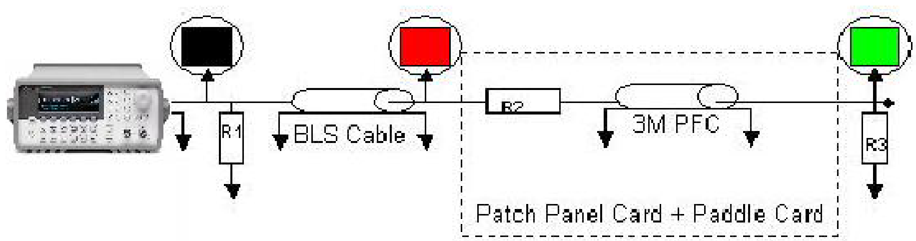


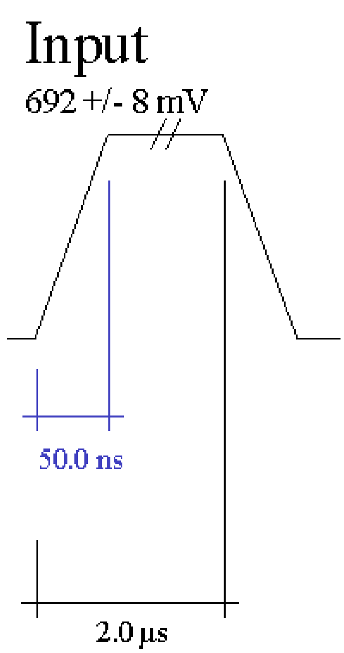
Figure 1: BLS cable connected to the transition system (patch panel card, pleated foil cable and paddle card). Pulse generator Agilent 33250A and oscilloscope Tektronix Digitizing Signal Analyzers DSA 602A

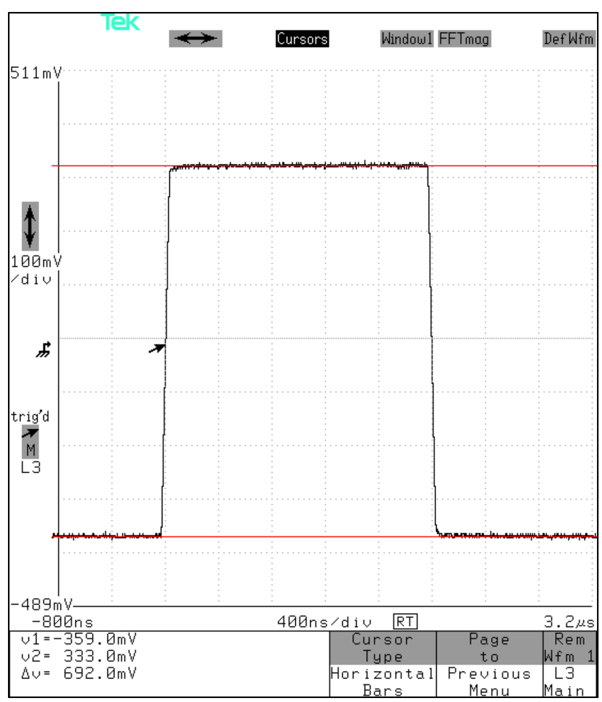
For termination we used:
R1 = 108.2 +/- 0.5 Ohms
R3 = 73.0 +/- 0.5 Ohms

The match the BLS cable characteristic impedance and the Pleated Foil one we used:
R2 = 7.0 +/- 0.1 Ohms

R1 was adjusted to offer 50 Ohms to the pulse generator. Since the R2+R3=~80 Ohms. But the value needed for R1 to keep constant the amplitude of the signal was ~108 Ohms.
To explain this difference we have to considerer that the BLS cable is ~150 ft long with a DC resistance of ~13 Ohms.

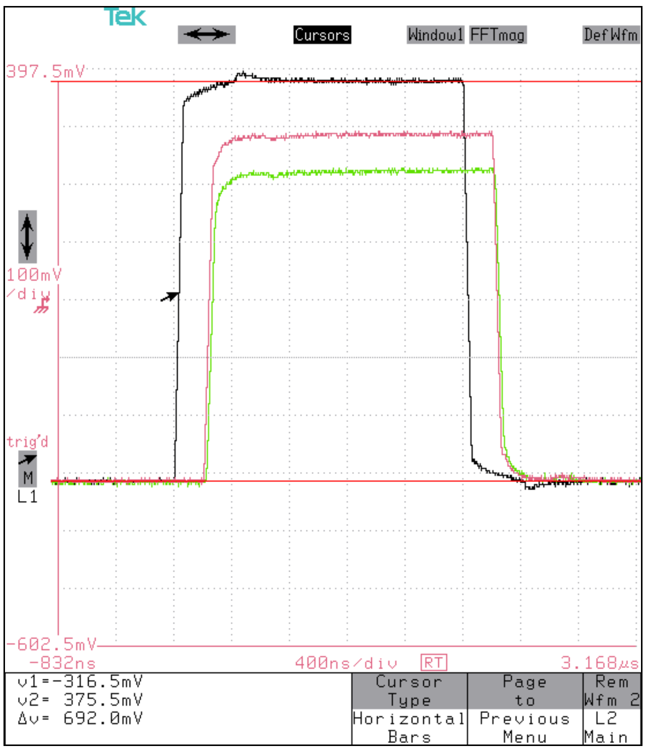
Unplugged pulse (bare pulse):





We decided to use a 700 mV pulse to get a good relation signal/noise (~1%) since the pulse generator has an accuracy of +/- 1% +/- 1mV

Input pulse (black):
692 +/- 8 mV
Output of the BLS cable (red):
598 +/- 7 mV
Output of the transition system (green):
538 +/- 6 mV



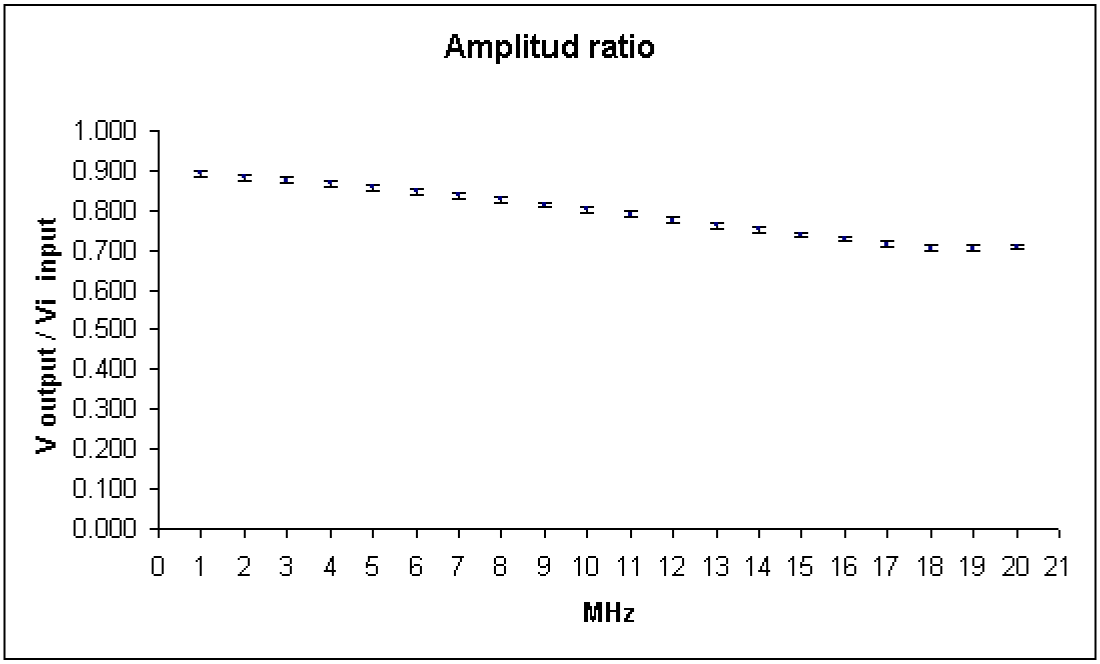
For DC the fraction of the signal coming out of the transition system related with the output of the BLS cables is 90.0 +/- 1.5 %
The glitch in pulse is related with the apparatus and probes we are using and also with the frequency responses of the BLS cable itself. We can see that the output of the transition system (green signal) follows the output of the BLS cables (red signal)

2. Frequency analysis

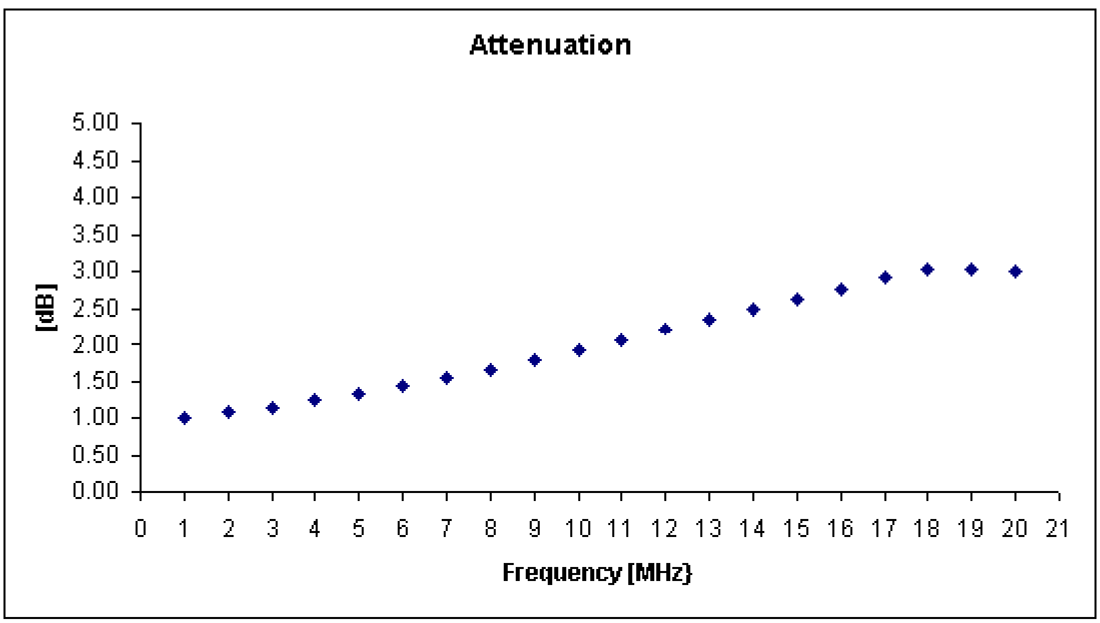
Input:
Sinewave signals of 700 mV and (noise/signal 1%) from 1 MHz to 20 MHz.

Fraction of the signal coming out of the transition system related with the output of the BLS cables:

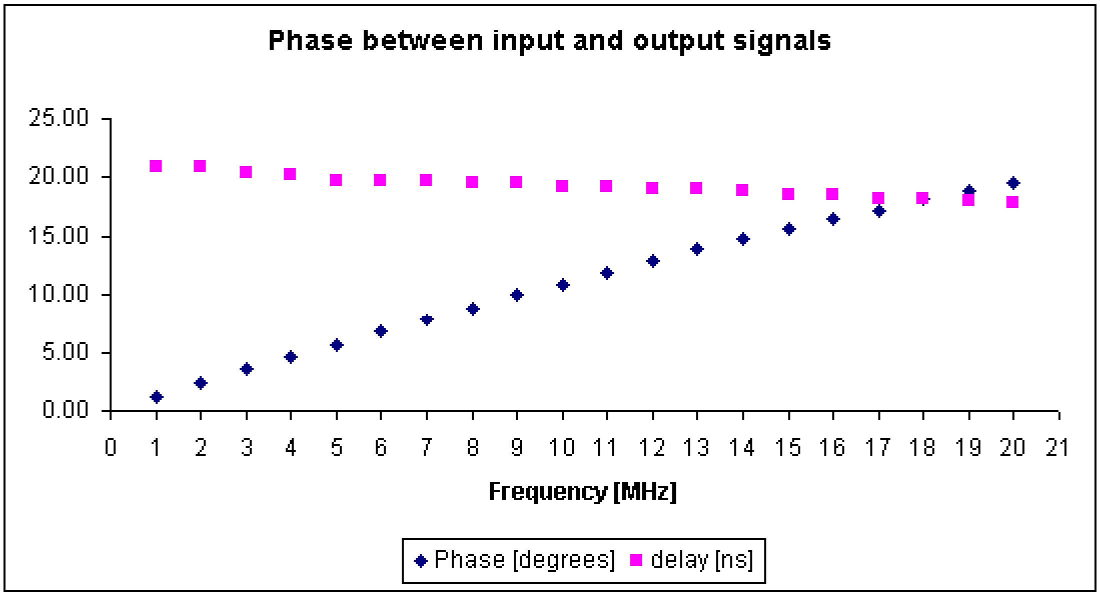
Going from 90 % for low frequencies to 70% for 20 MHz



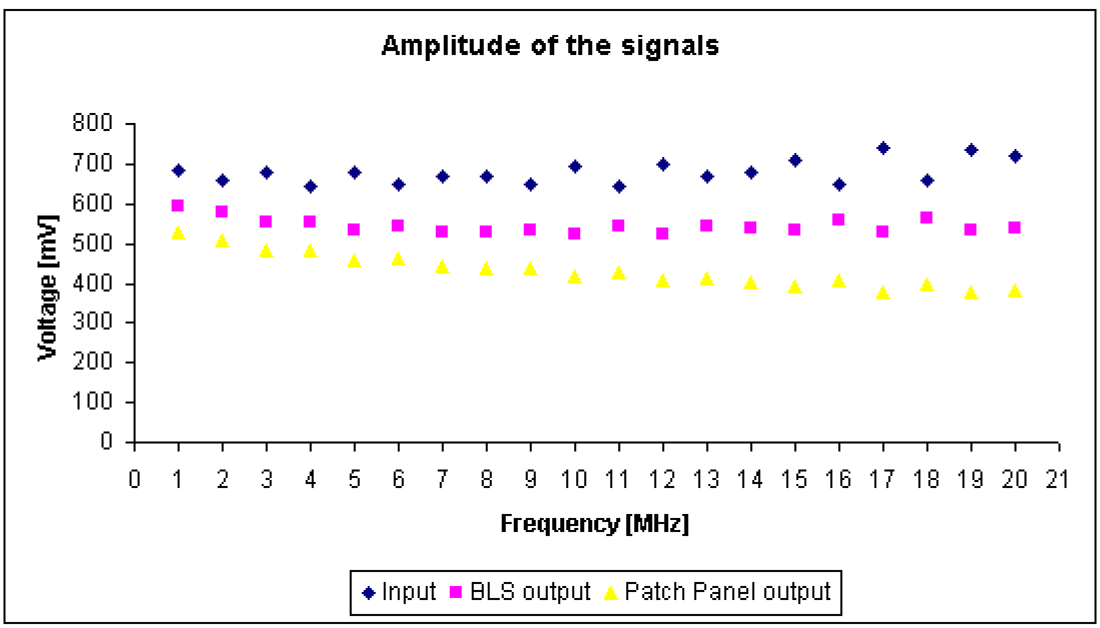
Then the attenuation goes from 1dB to 3dB for 20 MHz:



The delay introducing for the transition system is around 20 nsec.



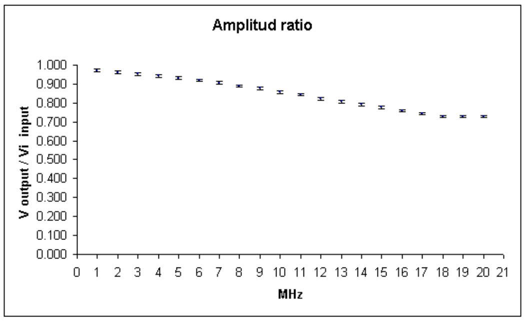
The signal amplitudes as a function of the signal frequency:
Blue: Input of the BLS cable
Magenta: Output of the BLS cable
Yellow: Output of the Transition System

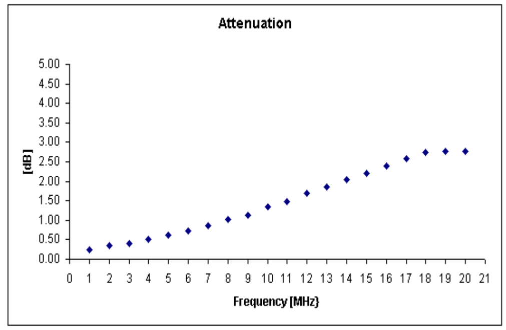


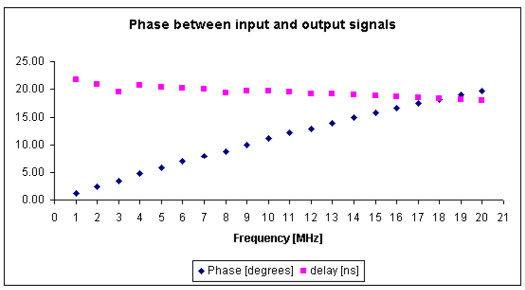
Conclusion:

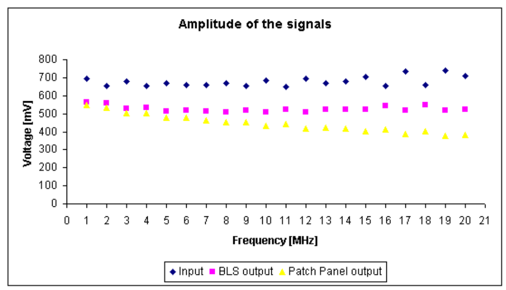
- Introducing a 7 Ohm resistance to match the BLS impedance with the pleated foil cable the fraction of the signal coming out of the transition system related with the output of the BLS cables goes from 90% at 1MHz to 70% at 20MHz.
- The output impedance of the Transition System is equal to the impedance of the Pleated Foil cables 73 Ohms with a 10% tolerance range.

- The same frequency analysis was repeated for different values of the resistance we use to match the BLS cable with the PFC. It wasn't possible to see differences with resistance between 0 to 10 Ohms. With 15 Ohms we could see some reflection in the interface.
- Using 0 Ohms (default for the Patch Panel Cards) the frequency analysis shows that the fraction of the signal coming out of the transition system compare with the output of the BLS cable goes from 97% to 70%. Then the attenuation is going down faster than the attenuation measured using 7 Ohms.









Appendix

Function/Arbitrary Waveform Generator
Agilent 33250A
http://cp.literature.agilent.com/litweb/pdf/5968-8807EN.pdf

Oscilloscope
Tektronix Digitizing Signal Analyzers DSA 602A
With 11A34 FOUR TRACE AMPL; 50/1 MEG INPUT, PLUG-IN UNIT
http://www.tek.com/Measurement/cgi-bin/framed.pl?Document=/Measurement/Products/catalog/archive/ca-DSA602A/index.html&FrameSet=oscilloscopes

3M Pleated Foil Shielded Cable
./Mediawebserver.pdf